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REPRODUCTIVE PERIODS OF *PHIDIPPUS* SPECIES (ARANEAE, SALTICIDAE) IN SOUTH CAROLINA[1]

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ABSTRACT

Observations were made on the reproductive periods of nine species of *Phidippus* occurring in South Carolina. *Phidippus audax* (Hentz) oviposited from May through the following early spring, while most other species had much shorter and seasonally defined oviposition periods. The reproductive periods noted in these studies were similar to published reports from other regions where these species occur.

INTRODUCTION

The occurrence of *Phidippus* spp. in South Carolina has been reported by Roach and Edwards (1984) and Gaddy and Morse (1985). Many of these species occur in the same habitats and are often difficult to separate taxonomically. The use of genetic product analyses to identify and to study the phylogenetic relationships of many of the species that occur in the southeastern United States was reported by Terranova and Roach (1987a, 1987b). Because the immatures of several species may compete for habitat and prey concurrently, it is important to know the seasonal phenology of each species. Most studies of *Phidippus* spp. reproduction cycles in the literature are limited to observations on the egg sacs of individuals or a limited number of species in a geographical region. These studies were reviewed by Edwards (1980) who also reported his observations on the reproductive cycles and egg masses of *Phidippus* spp. occurring in Florida. In this report, I present a summary of seven years of observations on the reproductive periods of nine of the eleven *Phidippus* spp. occurring in South Carolina and compare these periods to those reported from other parts of each species range.

METHODS

During the course of collecting salticids for other studies (Roach 1983; Roach & Edwards 1984; Terranova & Roach 1987a,b), numerous specimens of *Phidippus* spp. were captured and held for observation. Collection methods

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varied according to habitat being sampled, but were primarily by sweep-net sampling and visual searching. Spiders thus collected were placed in clear plastic containers (8 × 8 or 8 × 4 cm) and held in a programmed environmental cabinet at 27 ± 2°C, RH 50 ± 10%, and a photoperiod of 14:10 (L:D). Spiders were fed *Heliothis* spp. larvae approximately the same size as the spider every 2 to 3 days until the natural death of the spiders. Observations on egg sac production included in this report are from gravid females collected in the wild.

RESULTS

The most commonly collected species of *Phidippus* in field habitats in South Carolina is *P. audax* (Hentz). This species began egg sac formation and oviposition in early May, and continued through most of the year (Table 1). Multiple egg sacs by *P. audax* were common, with an average of 2.75 per female. Table 2 shows the number of eggs per sac and the relative periods of their occurrence. In these observations, the mean number of eggs per sac (60) was about equal for all except possibly the sixth, even though the range (15-164) of eggs per sac was quite variable.

Phidippus clarus Keyserling was most frequently collected from old field habitats and lakeshore areas, and generally shared the same habitats as *P. audax*. However, the seasonal reproductive cycle of *P. claris* was more restricted than *P. audax* (Table 1). *P. clarus* females oviposted during August and September and spiderlings dispersed from September through January.

Another species that occupied habitats similar to *P. clarus* and *P. audax* was *P. princeps* (Peckham & Peckham). However, it was only found in old field habitats, particularly in wooded areas, and on young pines in reforested areas. This species was common, but less generally distributed than *P. clarus* over the areas sampled. Only two gravid females were observed in this study. During the period from February to April, one produced a single egg sac and the other produced two egg sacs. The average number of eggs per sac (32) was considerably less than that of the previous two species.

Phidippus mystaceus (Hentz) has been collected only from the western foothills of South Carolina. Two gravid females included in this study were collected with egg sacs on 28 February and 23 March in Pickens County, SC by J. Brushwein. Each female produced only one egg sac, one with 76 and the other with 92 eggs (Table 1). Spiderlings from both egg sacs dispersed during mid April. Collection records from Pickens County indicated this species is found on shrubs, trees, and on the ground under protective coverings.

Phidippus otiosus (Hentz) was collected state-wide and is primarily an arboreal species. This species matured during the fall and produced egg sacs from December to February (Table 1).

Phidippus whitmani Peckham & Peckham was also collected statewide exclusively from woods litter, primarily in older, mixed hardwood areas. Of six females observed, oviposition occurred in July and August, and no female produced more than one egg sac (Table 1).

The remaining species included in this report (Table 1) were rarely collected and thus observations on these species are limited. *Phidippus putnami* (Peckham & Peckham) adults were collected from low limbs on the edge of mixed

Table 1.—Oviposition periods, fecundity, and spiderling dispersal of *Phidippus* species in South Carolina. *—Spiderlings dispersing when found so number may possibly be lower than normal. **—Not counted; dispersal observed.

Species	Number observed	Oviposition period	$\bar{X}$ Egg sac/ female	Range of egg sac/female	$\bar{X}$ Eggs /egg sac	Range of eggs/egg sac	$\bar{X}$ Total eggs/female	Spiderling dispersal period
P. audax	11	May-Mar.	2.75	1-6	64.0	15-164	192	4 June-3 Mar.
P. clarus	6	Aug.-Sept.	1.7	1-3	83.3	7-207	150	23 Sept.-25 Jan.
P. princeps	2	Feb.-Apr.	1.5	1-2	32.0	21-60	48	9 Mar.-10 July
P. mystaceus	2	Feb.-Mar.	1	1	84.0	76-92	84	14 Apr.-18 Apr.
P. otiosus	3	Dec.-Feb.	1.3	1-2	101.0	19-150	135	21 Jan.-13 Feb.
P. putnami	1	Oct.	1	1	47*	47*	47*	Oct.
P. regius	1	Jan.	1	1	138	138	138	23 Feb.
P. whitmani	6	July-Aug.	1	1	43.3	19-62	43.3	5 Sept.-16 Nov.
P. cardinalis	2	Mar.-Apr.	1	1	NC**	-	NC**	April-May

Table 2.—Observations on *Phidippus audax* egg sacs and the periods of spiderling dispersal in eastern South Carolina. Numbers in parentheses indicate number of egg masses observed.

	Egg sacs					
Observation	1st	2nd	3rd	4th	5th	6th
$\bar{X}$ Spiderlings per egg sac	71(11)	68(9)	54(5)	68(4)	67(2)	31(1)
Range of spiderlings/egg sac	31-164	15-127	31-67	47-97	46-88	31
$\bar{X}$ Date of spiderling dispersal	27 June	6 Aug.	3 Sept.	30 Sept.	23 Oct.	3 Mar.
Range of spiderling dispersal dates	4 June-14 July	15 July-27 Aug.	7 Aug.-11 Sept.	26 Sept.-8 Oct.	23 Oct.-15 Nov.	Mar.

hardwood areas during late summer and early fall. Only one gravid female was collected with an egg sac and the spiderlings were possibly dispersing when found. This female did not produce another egg sac before dying in December.

Phidippus regius C. L. Koch was collected only in coastal areas, and again only one gravid female was observed. It was collected in November and produced one egg sac in February (Table 1).

Phidippus cardinalis (Hentz) was collected only in the foothills area of the state by J. Brushwein. He collected two females with egg sacs in March and April, 1986, but unfortunately did not count the number of eggs per sac.

DISCUSSION

Phidippus audax occurs widely over most of the United States and several reports of seasonal occurrence are available. Gibson (1947), in Tennessee, reported that *P. audax* overwintered as immatures and adults but did not deposit eggs until July. Kaston (1981) indicated that adults matured in late April to early May in Connecticut and laid eggs in June and July, with single females constructing up to three egg sacs. Snetsinger (1955), in Illinois, reported that *P. audax* mated in May and June and deposited eggs in June and July. Edwards (1980) indicated a maturation period primarily in May and June for Florida. Taylor & Peck (1975) compared southern Texas and northern Missouri forms of *P. audax*, and indicated a spring maturation period with up to six egg sacs per female, averaging 41.7 to 85.5 young per egg sac. They also found that later egg sacs for each female contained fewer young than earlier deposited egg sacs. These results are similar to those found in the present study except that egg sacs deposited successively did not contain fewer eggs than those produced earlier, with the possible exception of the sixth egg sac.

Oviposition, by *P. clarus* was observed in August-September in South Carolina. Kaston (1981), in Connecticut, reported mating of *P. clarus* in June and observation of an egg sac in late July; he also indicated a *P. clarus* female was collected on 31 August while guarding an egg sac with 47 eggs. Snetsinger (1955) observed mating of *P. clarus* in Illinois from late June to early August and egg sac formation August to October. Edwards (1980) reported *P. clarus* matured in July and August in Florida. Although there is variability in maturation in this species, egg sac formation occurs primarily from late July to October in the geographic area from Florida to Illinois.

Kaston (1981) reported that *P. princeps* matured in April and May in Connecticut and laid eggs as early as May; he also reported collecting a female guarding eggs on 10 June. Cutler (1965), in New York, reported seeing adults in September. In Florida, *P. princeps* is uncommon, but Edwards (1980) stated that the oviposition period was from May to July. All of these periods are somewhat later than the February-April oviposition period noted in South Carolina.

Berry (1970) reported collecting a single adult of *P. mystaceus* in June in the Piedmont region of North Carolina. Kelley (1979) collected several mature specimens in Pickens County, SC, and indicated the breeding season is from April to May in that area. Edwards (1980) indicated the oviposition period of *P. mystaceus* in northern Florida is October through May. Kaston (1981) indicated that this species is rare in Connecticut. Present observations on spiders collected

in Pickens County, SC indicated that oviposition by *P. mystaceus* occurs in February and March. Thus, in its eastern range, *P. mystaceus* apparently matures during the fall and winter and breeds during spring and early summer.

Phidippus otiosus (also known as *P. pulcher*) is primarily a Southeastern species and the only extensive phenology of this species reported in the literature is by Edwards (1980) for northern Florida. He indicated this species matures from September to November and oviposits from January to June. In South Carolina, this species matured in the fall and the collected females oviposited from December through February.

The only information found in the literature on the reproductive cycle of *P. putnami* is for northern Florida (Edwards 1980). He reported that this species matured in July and August, and oviposited from August through October. The collection of adults in late summer and early fall, along with the collection of an egg sac in October, indicate a similar cycle in South Carolina.

Phidippus regius is primarily a southeastern species which matures during September and October and oviposits from October to June in Florida (Edwards 1980). My observations indicate a similar cycle for *P. regius* in the coastal area of South Carolina.

Phidippus whitmani is a widely distributed species that matures in May in Connecticut (Kaston 1981), June in North Carolina (Berry 1970), and May or June in Florida (Edwards 1980). In South Carolina, the pattern is similar, with adults collected during the summer and oviposition observed during July and August.

Kaston (1981) reported that *P. cardinalis* adults were collected in Connecticut from late May to October, while Edwards (1980) indicated that in Florida the species matures from September to November and oviposits February through May. *Phidippus cardinalis* was only collected with egg sacs during March and April in South Carolina and apparently is not a common species over most of the state. Thus, this species may have a somewhat later maturity period in its more northern range.

Two other *Phidippus* species, *P. apacheanus* Chamberlin & Gertsch and *P. purpuratus* Keyserling, also occur in South Carolina but no adult females have been collected and observed so their phenology in the region is unknown. However, Edwards (1980) indicated that *P. apacheanus* matured in September-October in northern Florida, while Gardner (1965) reported that the species matured during the same period in the area around Reno, Nevada. *Phidippus purpuratus* is more common in the northeastern states and adults occur from May-September in Connecticut (Kaston 1981).

In summary, the reproductive periods of the various *Phidippus* species vary in time of occurrence and possibly in other phenological parameters. The information found in the report should be useful in predicting what stage of each species will be present in various habitats during certain periods of the year.

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